

NHDES Internal Memorandum

To: Files

Date: 3/29/02

From: Gregg Comstock, P.E.

Bureau: Watershed Management Bureau

Subject: Assessment Units (AUs)

The purpose of this memorandum is to describe the approach that will be taken to develop assessment units and index them to the National Hydrography Dataset for the 2002 Integrated Listing Report.

1. Use NHD as base coverage: As required by EPA, the NHD coverage at 1:100,000 scale will be used as the base coverage for reporting purposes. Note that the hydrography shown on the NHD is close to the hydrography used on the old RF3 files. At this time we don't intend to use the USGS NHD coverage for the following reasons:

- a. It doesn't work with the upstream trace tool. This will hamper our efforts to create Assessment Units.
- b. It may not work with the index tool. Ken will call USGS to confirm.
- c. This coverage has not been adopted by EPA as the NHD coverage for New Hampshire.
- d. We haven't received the USGS coverage yet and need to start indexing Assessment Units (AUs) now.

2. Assessment Units (AUs) – General Considerations: Assessment Units (AUs) are the basic unit of record for conducting and reporting the results of all water quality assessments. According to EPA, AUs should not span more than one water quality standard, should be larger than a sampling station but small enough to represent a homogenous standard attainment unit within individual assessment units. EPA wants all AUs linked to the National Hydrography Dataset (NHD), which is at 1:100,000 scale. Where a state's or territories spatial resolution is on a finer scale than NHD, EPA will translate that resolution into the NHD system. Reaches on the NHD are typically defined from confluence to confluence and have a unique number. AUs may comprise part of a NHD reach, an individual NHD reach or a collection of NHD reaches and or parts of reaches. Each AU should include the following descriptive information:

- unique AU identifier (AU ID)
- AU's type (river/stream, lake/reservoir, coastal shoreline, wetland, etc.)
- AU's size and units of measurement
- AU's name and location on the NHD
- AU's designated use

In New Hampshire, NHD reaches for rivers/streams average approximately 1 mile per reach. If each reach was assigned to be an individual AU, we would have approximately 11,000 reaches to report on at 1:100,000 scale and even more when we transition to 1:24,000 scale. This would be quite unmanageable and is unnecessary. The key is to develop assessment units that are relatively homogenous as far as their proximity to pollutant sources, the way that they would respond to pollutants (ie, their physical characteristics) the water quality standards which apply and to keep them of reasonable size (ie, not too large) so that they reasonably represent the extent of the assessment decision for that unit. In general, the size of assessment units must strike a balance between being too small and numerous that they cannot be practically assessed within a reasonable timeframe and too large and diverse that they cannot be assessed with reasonable accuracy. Once assessment units are created, the assumption is that data from any sampling station within the assessment unit is representative of the entire AU and can be used to assess it. Hopefully there is at least one station located at the downstream end of the AU. Data from multiple stations within an AU can be aggregated to assess the AU. If any of the sampling stations indicate impairment, then the whole assessment unit will be shown as impaired. Likewise if the data indicates no impairment, the AU would be assessed as fully supporting for the use or uses for which there is data.

As long as the AUs are relatively homogenous and kept to a reasonable size, they should be accurate enough for reporting purposes and shouldn't result in gross misrepresentations of the size of waters meeting

or violating water quality standards. The important thing to bear in mind is that regardless of how accurately an AU represents the extent of the attainment decision, attention will be focused on that AU for follow up work if it is assessed as impaired. Follow-up investigations would initially focus on the sampling stations in the AU that indicated impairment, the exact locations of which are known. These investigations would better define the extent of impairment. If desired, a separate AU could be created to more accurately reflect the extent of impairment, however, we envision this would be the exception rather than the rule in order to keep the number of AUs to a manageable number. Again we envision that AUs, once created, will be accurate enough for reporting purposes.

Based on discussion above, the following factors will be considered for developing AUs. For most rivers and streams, AUs will consist of multiple “homogenous” NHD reaches. For most lakes, the entire lake will be assigned to one AU. All AUs will be indexed to the NHD reach coding system as requested by EPA. This includes points that are added to represent waterbodies not shown on the current NHD (see item below regarding addition of waterbodies not shown on NHD):

Factors that will be considered for developing AUs.

*** Guidelines to keep AUs of reasonable size:**

HUC 12 boundaries: Waterbodies that cross 12 digit Hydrologic Unit Codes (HUCs) will be broken into separate AUs (there are about 400 12 digit HUCs in NH).

Maximum Waterbody Size for rivers:

No more than 10 miles per AU for rivers/streams that are 3rd order or less.
No more than 25 miles per AU for rivers that are greater than 3rd order.

*** Waterbody Type:** Different types of waterbodies will respond to pollutants differently. For example a fast moving river will respond differently to nutrient loadings than a slow moving impoundment or lake. Consequently, to be homogenous, separate AUs should be developed for different waterbody types. Waterbody types that will be considered for this report include rivers/streams, lakes, impoundments, reservoirs, estuaries, and open ocean. In the future, freshwater and tidal wetlands, and possibly others, will be considered. Breaking out waters by waterbody type also addresses differences in water quality standards (designated uses and water quality criteria) for different types of waterbodies. For example, rivers have different dissolved oxygen criteria than lakes, ponds, impoundments and reservoirs. This is further discussed below.

*** Changes in Water Quality Standards (Legislative Classification, Designated Uses and Criteria):**

Overview: To keep AUs homogenous and as representative as possible, AUs should be created wherever there is a change in water quality standards (designated uses and water quality criteria). If different water quality standards were allowed to apply to one AU, it is possible that a portion of the AU would meet standards while the other would not. As only one assessment can apply per AU, it would not be possible to accurately report the quality of the waterbody without splitting it into two AUs. To avoid situations like this from happening in the first place, separate AUs should be created wherever there are changes in water quality standards. Separating AUs in this manner will also make it easier for assessors to know which criteria apply for making attainment decisions.

Legislative Classification: To keep AUs homogenous and assessments as representative as possible, AUs should be created wherever there is a change in water quality standards. New Hampshire has two legislative classifications, A and B. Although designated uses are essentially the same for each (with the exception of drinking water for tidal purposes), there are differences in water quality criteria between the two classifications. For

example, Class A waters have different bacteria standards than Class B waters. Consequently Legislative Classification will be used to determine AU boundaries. This will also satisfy a desire of DES to be able to report separately on the status of Class A and / or Class B waters.

Designated Uses: Although New Hampshire has two different surface water classifications (A and B), the designated uses for each are assumed to be the same (ie., acceptable for fishing, swimming, and other recreational purposes, and, after adequate treatment, for use as water supplies). However, although not explicitly stated in the law, it is believed that the legislature did not intend for tidal waters (which are Class B) to be suitable for drinking after adequate treatment. Consequently, tidal and freshwaters should have different AUs. As mentioned above, different AUs will be established for tidal and freshwater systems because they are different waterbody types; consequently the need to create separate AUs based on differences in designated uses will also be addressed.

Water Quality criteria: As mentioned above, water quality criteria can differ depending on the legislative classification and waterbody type. In addition, water quality criteria also differ for the following reasons which will also be used as criteria for creating new AUs:

Designated Beaches have stricter bacteria requirements than other waterbodies. Consequently it is important to assign separate AUs for designated beaches. Assigning separate AUs to each beach will also facilitate reporting on the status of each beach. Designated beaches include public beaches that the DES Watershed Management Bureau inspects each year. There are a total of 237 beaches with 193 being on lakes, 13 on rivers, 12 on impoundments, and 19 on the coast. Details on how the size of AUs will be determined for each are discussed below for each waterbody type. Where available beach length will be taken from <http://www.epa.gov/ost/beaches/>.

Cold water fish spawning areas: Cold water fish spawning areas have different dissolved oxygen criteria than other surface waters. These areas need to be identified by NH Fish and Game Department and reported to DES pursuant to Env-Ws 1703.07(c). To date, DES only has this information for the Merrimack Basin and selected other locations of the state. AUs have been attributed the fishery type where available. Once additional cold-water fish spawning areas are identified, AUs will be reviewed to determine if new AUs should be created or if the boundaries of some AUs should be revised.

* **Pollutant Sources:** Point and nonpoint sources can have a significant impact on water quality and consideration will be given to creating new AUs where major pollutant sources exist. These include NPDES discharges, superfund sites, landfills etc. Existing GIS layers will be used to identify these sources.

* **Major changes in Land Use:** Land use can significantly impact the type and amount of pollutant loadings to a surface waters and should, therefore, be considered when determining the boundaries of AUs. Existing GIS coverages showing land use, road networks and conservation lands will be considered when creating AUs.

* **Stream Order/Location of Major Tributaries:** Whether or not a pollutant will cause impairment, is dictated to a large degree by the amount of water in the surface water. In general, pollutants are less likely to have an adverse impact on uses when there is more water available to dilute it. Therefore, to keep AUs homogenous with regard to how they respond to pollutants, major sources of water, such as tributaries, should be considered when assigning AUs. This will

be accomplished by reviewing USGS maps and the existing GIS coverage for stream orders at 1:24,000 scale.

*** Other considerations:**

In addition to the above, AUs will also be created to facilitate reporting on the following:

Public Water Supplies: The DES Water Supply Engineering Bureau maintains a list of public water supplies. Each Public Water Supply will be assigned a separate AU to facilitate reporting on these waterbodies.

Outstanding Resource Waters (ORWs): ORWs include all surface waters of the national forests and surface waters designated as natural under RSA 483:7-a, I. AUs will be created for these waters to facilitate reporting on these waters.

Shellfish Program Categories: The DES Shellfish Program follows the National Shellfish Sanitation Program (NSSP) classification system. Separate AUs will be created for the estuarine and ocean waters assigned to each category under this system. This is discussed in more detail below under “Estuaries” and “Open Ocean”.

3. **AU Identification (ID) numbers:** A unique ID will be assigned to each AU using the coding system shown in the following table. Additional discussion on AUs is provided in the discussion for each waterbody type provided below.

Example: NHRIV-080402012-01-01

Explanation of AU ID elements:

NH	RIV	801040202 -	01-	01
State abbreviation to readily identify the waterbody as being in NH.	<p>3 letters to readily identify the waterbody type – see codes below.</p> <p>RIV = Rivers and Streams LAK = Lakes and Ponds IMP = Impoundments RES = Reservoir EST = Estuary OCN= Ocean CSH = Coastal Shoreline WDF= Wetland Freshwater WDT= Wetland Tidal</p> <p>(Bold indicates waterbodies that will be reported on in 2002)</p>	<p>Last 9 digits of the 12 digit HUC. Note that the first 3 digits of all NH HUCs are “010”. The first 3 digits (010) were purposely left off in an effort keep the AU ID as short as possible. Inclusion of the last 9 digits readily identifies the general location of the waterbody.</p> <p>12 digit HUCs do not exist for the ocean (they do, however exist for the estuaries). For the ocean, 000000000 will be input into this field.</p>	<p>AU segment number. Segments will be broken up into homogenous units using the criteria above. For rivers, segment numbering will start upstream and proceed downstream.</p>	<p>AU subsegment number. Used for further subdivision of AU if necessary. For example if it is necessary to divide a lake into 2 or more segments, this field would be used.</p>

4. Adding waterbodies to NHD:

- a. If it is necessary to show a waterbody that is not already shown on the NHD coverage, we will add it. We will try to avoid doing this as much as possible in order to keep the number of AUs down to a manageable number. .
- b. It should be recognized that waterbodies added to the NHD coverage can only be added as *points* regardless of their type or size. This is drawback as far as being able to produce

maps for the public. The corresponding Assessment Database (ADB) attribute table will, include the appropriate size for reporting purposes, however this won't be shown accurately on a map.

- c. Waterbodies that are added can and will be linked to the NHD coverage. For points, the link is equal to an offset from an NHD reach.

5. Rivers and Streams (miles):

- a. The miles of rivers and streams reported on in 2000 will probably be a little different than the total miles reported on in 2002 due to differences in coverage and the way that total miles was calculated between the NHD and the old RF3 files. The old RF3 files, for example, assumed that the miles of streams entering some lakes or ponds were equal to the circumference of the lake. Nevertheless, the total miles using the NHD should be close to what we reported in 2000. We will not attempt to obtain an exact match as the total miles of rivers and streams is going to increase significantly in the next year or two when we transition to 1:24000 scale. Therefore it does not make sense (nor do we have time) to fine tune the NHD coverage at this time knowing that the total miles of rivers and streams is going to change significantly in the near future.
- b. Rivers or streams that have data associated with them and that are not already shown on the NHD, will be added (as points) to the NHD coverage if they are of significant length. Lengths will be estimated from 1:24000 scale coverage. Once again, the goal is not to add AUs unless it is absolutely necessary.
- c. All designated beaches on rivers will be assigned a length of 0.1 miles (~ 500 feet).

6. Lakes (acres) :

- a. For lakes we will assign AU IDs for all lakes and ponds reported on in the 2000 305(b) report and show them on the NHD coverage. This includes approximately 900 lakes and ponds. It is believed that categorizing a waterbody by the name it is commonly referred to (ie, lake) will facilitate retrieval of assessment information by DES and the public.
- b. If it was reported as a lake or pond in 2000 we will call it a Lake (LAK) in 2002.
- c. It should be noted that when we transition to 1:24,000 scale, the total number of lakes currently reported by USGS is over 15,000.
- d. All designated beaches on lakes will be assigned an AU with an area of 0.50 acre.
- e. In NHD, lakes are indexed as polygons (instead of lines). They also have transport reaches. Consequently, lakes on the NHD can be subdivided into more than one AU and shown as polygons.
- f. The area for designated beaches will be set to 200' times the beach length where available and 200' times 300' (1.38 acre) where the beach length has not been measured.
- g. In cases where a lake lies in more than one HUC12, the HUC12 of the outlet portion of the lake will be used for coding the whole lake.

7. Impoundments (acres):

- a. Impoundments will include all waters directly behind dams labeled as "active" by the Dam Bureau (regardless of the dam height) that:
 - i. are not already included as a lake or reservoir
 - ii. are located on the NHD hydrology, or
 - iii. need to be added because we have data on them.
- b. The size (i.e., acreage) of the impoundments will be obtained from the dam bureau database. For impoundments that fall on the NHD hydrograph, the AU will be shown as a line with the distance upstream of the impoundment determined by dividing the impounded area by the dam length provided in the dam bureau database and multiplying this by a factor of 0.71. This factor was determined by the analysis provided in Appendix A. Where it is necessary to add impoundments that do not fall on the NHD

hydrography, they will be added as points. Further refinement will be made by evaluating the digital-ortho-photos in cases where the dam database shows impoundment sizes of zero or the calculated length is suspect.

- c. According to the dam bureau, there are about 5000 dams in NH. Many are either inactive or won't be shown at 1:100,000 scale coverage in 2002.
- d. This will be the first time that we will have used the Impoundment waterbody type for reporting.

8. Estuaries (square miles):

- a. Estuaries will be divided into separate AUs according to the following
 - i. The AUs will first be divided by the names of the major estuaries identified by the Shellfish Program as shown in Appendix B (the Shellfish Program calls these waterbody units): These will be assigned to the main segment number.
 - ii. The major estuaries will then be subdivided into sub-segments using the National Shellfish Sanitation Program (NSSP) classification system (sub-segments). It is necessary to report on these subcategories because they will result in different attainment decisions and have different causes and perhaps sources of impairment.
 - 1. Approved:
 - 2. Conditionally Approved
 - 3. Restricted
 - 4. Conditionally Restricted
 - 5. Prohibited
 - 6. Prohibited – Safety Zone
 - 7. Prohibited - Unclassified
 - iii. Size (square miles) for each AU will be obtained from the Shellfish program (see Appendix B).
 - iv. Subsegments will also be made around any designated beaches, if they exist. Any designated beach on an estuary will be assigned an area of 0.01 square miles.
- b. In NHD, estuaries are not shown as polygons but do have transport reaches through most of them. We will index the transport reach, some will be made by dividing the transport reach itself and others will be added as points. Because polygons cannot be used for indexing in the estuaries, the resulting NHD map of the estuaries will not be very useful to DES or the public. For a more meaningful map of the shellfish status, the GIS coverage developed by the Shellfish Program will have to be used.
- c. Estuaries do have 12 digit HUCs.

9. Ocean:

- a. The Atlantic Ocean will be subdivided according to the following:
 - i. NSSP classifications (see Appendix B for classifications and acreages)
 - ii. Designated Beaches
- b. AUs will be shown as points on NHD. Since polygons cannot be indexed on NHD for the ocean, this will not produce a map that is meaningful to the public.
- c. The area for designated beaches will be set to 200' times the beach length where available and 200' times 300' (1.38 acre) where the beach length has not been measured.

- 10. Coastal Shoreline (miles):** In the past we have reported on the coastal shoreline. I propose that we not do this anymore and instead capture this part of the assessment under the "Ocean" waterbody type, which is reported in square miles. To do otherwise would be double counting.

11. Wetlands (acres): As in the past, we will not include AUs for wetlands this year as it would be very difficult to assign AUs to them at a scale of 1:100,000. Furthermore, we don't have any numeric water quality criteria for assessing wetlands and we haven't defined what constitutes a wetland. Consequently we will not report on wetlands this year. When we transition to 1:24,000 scale we will assign AUs to wetlands.

12. Size of impaired waters is likely to increase this year due to a change in methodology: In the past, if a sampling station indicated impairment, we typically assigned a length of 1 mile. This year, the mileage of the AU that the sampling station is in, will be used for reporting purposes. Since AUs will typically be larger than 1 mile, it is possible that the number of miles reported as impaired this year will be higher. This however, may be offset by other changes in our assessment methodology (i.e., total number of samples needed to make an assessment).

13. Reasons why AUs are likely to change in the near future:

Overview: The AUs that we develop this year will likely change significantly in the near future for the reasons below. In general, AUs will be in a state of flux until we transition to 1:24,000 scale, obtain important fishery information from NH Fish and Game and settle on water quality standards. Until AUs and the waterbody they represent are held constant, it will be difficult to compare assessments for a given waterbody from one year to the next. If the AU ID changes for a given waterbody we will need to maintain a database of all the AUs ever assigned to that waterbody in order to track assessments over the years.

- a. Number and size of lakes, impoundments, reservoirs, rivers and streams etc. is likely to increase significantly when we transition to 1:24,000 scale. Therefore the number of AUs will likely increase significantly.
- b. We will probably be adding AUs for wetlands (Freshwater and Tidal) when we transition to 1:24,000.
- c. AUs created in 2002 may change in the future based on new definitions of lakes, impoundments, reservoirs and wetlands. Some AUs will likely change when we get cold fish spawning information from NHFG.
- d. AUs will likely change as water quality standards change (i.e., biomonitoring and nutrient data based on ecoregions and better definition of designated uses).
- e. NHFG has not provided cold-water fish spawning locations. If and when we get this coverage, it may affect AUs.

Appendix A

Impoundment Length Refinement for 1:100,000 NHD Indexing
KJ Edwardson
3/28/2002

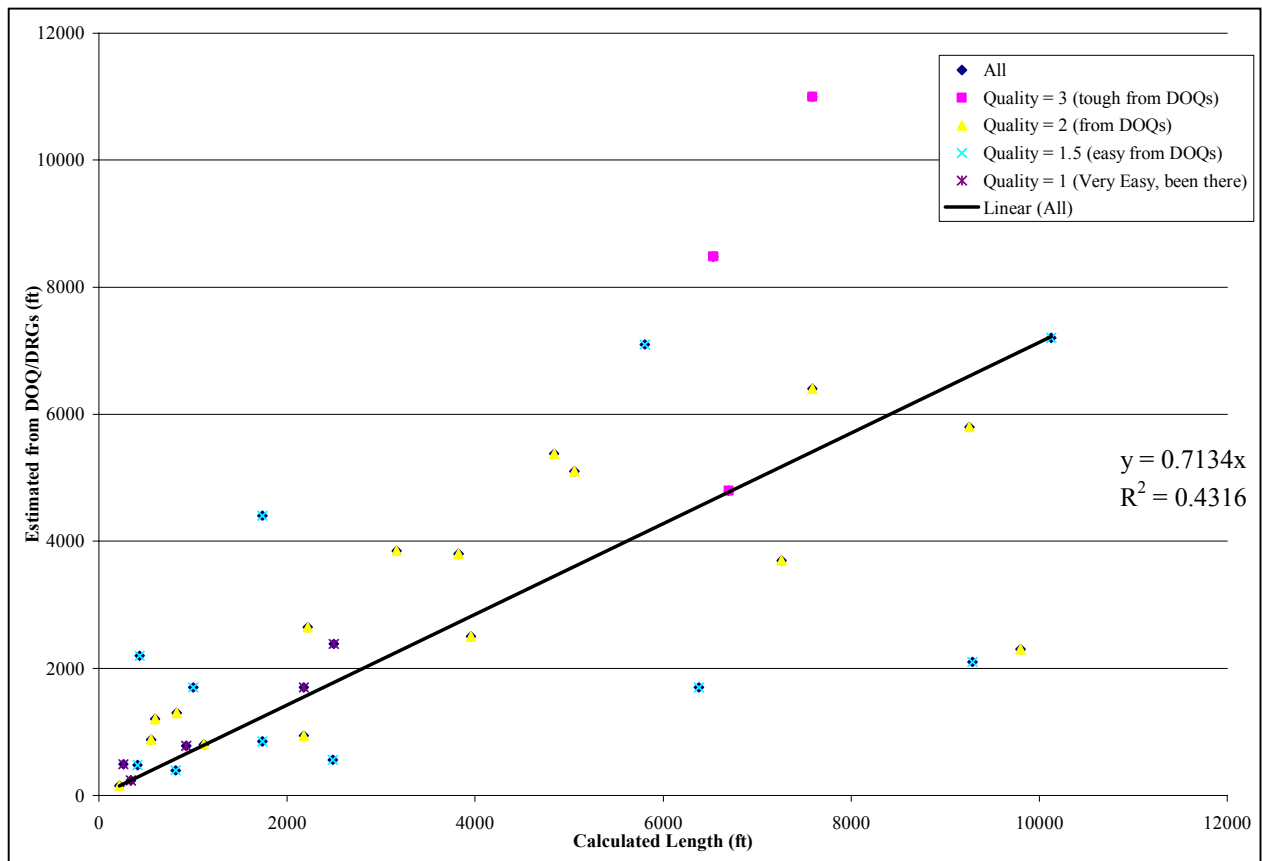
To further refine the estimate of impoundment lengths, 35 impoundments with “watershed to impoundment” ratios from 475 to 300,000 were selected and evaluated in Arc View using ariel photography (DOQ’s), USGS topo-quads (DRG’s), and knowledge of the areas to measure the impoundment lengths. The relationship between the original calculated impoundment lengths (Impoundment sq. feet divided by dam length in ft), suggested that we were over estimating impoundment lengths (see Figure). (Since impoundments are typically sited at constrictions one might expect the upstream impoundment tends to spread in the upstream valley.) The impoundment length to be mapped onto the NHD line work will be:

$$\frac{(A_I)}{(L_D)} * 0.71$$

Where:

A_I = Area of the Impoundment in Square Feet

L_D = Length of the Dam in Feet



Appendix B

Information provided by the Shellfish Program (for Estuaries and Ocean waters)

WATERBODY UNIT	CLASSIFICATION	OPEN/CLOSED	WATER TYPE	WATER ACRES	Subtotal (acres)	Subtotal (sm)
Atlantic Ocean (3 mile	Approved	OPEN	Ocean	26616.53		
Atlantic Ocean (1.5 mi	Conditionally Approved	OPEN	Ocean	12357.03		
Bass Beach	Prohibited	CLOSED	Ocean	21.98		
Chapel Brook	Prohibited	CLOSED	Ocean	21.34		
Eel Pond	Prohibited	CLOSED	Ocean	32.18		
Little River	Prohibited	CLOSED	Ocean	19.45		
Parsons Creek	Prohibited	CLOSED	Ocean	33.14		
Seabrook WWTP outfall	Prohibited/Safety Zone	CLOSED	Ocean	2173.13		
Star Island WWTP outfa	Prohibited/Safety Zone	CLOSED	Ocean	803.86		
Wallis Sands WWTP outf	Prohibited/Safety Zone	CLOSED	Ocean	23.71	42102	65.78
Rye Harbor	Prohibited/Unclassified	CLOSED	Estuary	46.97	47	0.07
Back Channel	Prohibited/Safety Zone	CLOSED	Estuary	421.64		
Upper Sagamore Creek	Prohibited/Unclassified	CLOSED	Estuary	95.86		
Lower Sagamore Creek	Prohibited/Safety Zone	CLOSED	Estuary	76.24		
Little Harbor	Conditionally Approved	OPEN	Estuary	197.98		
Wentworth-by-the-Sea M	Prohibited/Safety Zone	CLOSED	Estuary	14.73		
Witch Creek	Restricted	CLOSED	Estuary	93.34	900	1.41
Lamprey River	Prohibited/Unclassified	CLOSED	Estuary	102.56		
Squamscott River	Prohibited/Unclassified	CLOSED	Estuary	306.51		
Winnicut River	Prohibited/Unclassified	CLOSED	Estuary	123.50		
Bellamy River	Prohibited/Unclassified	CLOSED	Estuary	432.46		
Oyster River	Prohibited/Unclassified	CLOSED	Estuary	307.48		
Cocheco River	Prohibited/Unclassified	CLOSED	Estuary	158.24		
Salmon Falls River	Prohibited/Unclassified	CLOSED	Estuary	365.32	1796	2.81
Great Bay 1	Approved	OPEN	Estuary	3032.22		
Great Bay 2	Restricted	CLOSED	Estuary	741.66		
Great Bay 3	Prohibited	CLOSED	Estuary	442.19	4216	6.59
Upper Little Bay	Approved	OPEN	Estuary	1001.52		
Lower Little Bay	Prohibited/Unclassified	CLOSED	Estuary	52.24		
Lower Little Bay	Prohibited/Safety Zone	CLOSED	Estuary	177.74		
Lower Little Bay	Approved	OPEN	Estuary	457.07		
Lower Little Bay	Prohibited/Safety Zone	CLOSED	Estuary	16.09		
Lower Little Bay	Approved	OPEN	Estuary	106.98		
Lower Little Bay	Prohibited/Safety Zone	CLOSED	Estuary	28.01	1840	2.87
Blackwater River 1	Restricted	CLOSED	Estuary	69.47		
Blackwater River 2	Restricted	CLOSED	Estuary	71.07		

Browns River	Prohibited/Unclassified	CLOSED	Estuary	46.15		
Hampton Falls River	Prohibited/Safety Zone	CLOSED	Estuary	73.40		
Hampton Falls River	Prohibited/Unclassified	CLOSED	Estuary	7.09		
Hampton River 1	Prohibited/Safety Zone	CLOSED	Estuary	89.06		
Hampton River 2	Restricted	CLOSED	Estuary	65.60		
Hampton River 3	Conditionally Approved	OPEN	Estuary	23.04		
Hampton/Seabrook Harbo	Conditionally Approved	OPEN	Estuary	363.88		
Hampton/Seabrook Harbo	Restricted	CLOSED	Estuary	58.23		
Hunts Island Creek	Prohibited/Unclassified	CLOSED	Estuary	15.99		
Mill Creek	Prohibited/Unclassified	CLOSED	Estuary	31.35		
Taylor River	Prohibited/Safety Zone	CLOSED	Estuary	76.81		
Tide Mill Creek	Prohibited/Safety Zone	CLOSED	Estuary	55.97	1047	1.64
Upper Piscataqua River	Prohibited/Unclassified	CLOSED	Estuary	812.71		
Lower Piscataqua River	Prohibited/Unclassified	CLOSED	Estuary	1638.76	2451	3.83
Lower Portsmouth Harbo	Prohibited/Unclassified	CLOSED	Estuary	908.50		
Upper Portsmouth Harbo	Prohibited/Unclassified	CLOSED	Estuary	512.29	1421	2.22
					acres	square miles
Total Atlantic Ocean					42102	65.78
Total Estuary					13718	21.43